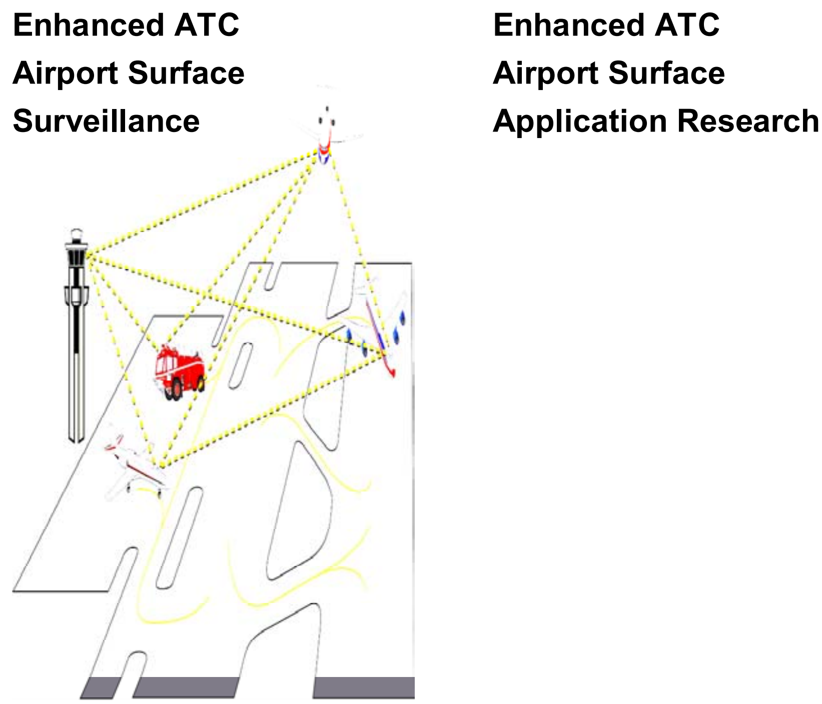
AD-6: Coordinate for Efficient Surface Movement

Improved planning, movement, and decision-making due to shared situational awareness of surface operations.



Background

The airport surface remains in many respects a procedural environment since information regarding identification, position, movement, and intent of aircraft and surface vehicles is maintained solely through controller observation and verbal communication. Even at airports with surface surveillance, controllers must rely on pilots and vehicle operators for position reports to validate their mental picture and, where available, a limited situation display to make control decisions. In addition, the lack of easily accessible planning information (including information on pushback, taxi, departure, and arrivals) results in inefficiencies for flight planning and scheduling, gate management, control, and servicing of aircraft. These uncertainties in surface movement contribute not only to an inefficient use of runways and taxiways, but also result in conflicting decisions with the arrival and departure functions due to demand projections based on inaccurate surface estimates.

The goal for surface operations, as stated in the NAS Concept of Operations, is to reduce constraints on the user when airport resource (runway, taxiway, gate, etc.) demand is high. Elimination of these constraints by a migration from a strictly procedural environment to an automated, collaborative environment would minimize the overall ground delay of arrivals and departures, while incorporating user business model preferences.

Ops Change Description

The establishment and distribution of real-time surface surveillance information will increase ground efficiency. Implementation of a seamless, real-time surface surveillance capability will reduce the range of uncertainty with regard to surface movement and resource demands.

For tower air traffic controllers positive identification and accurate real time position information for aircraft and surface vehicles will result in better and timelier decision making for surface operations. Controllers will need to request fewer position reports and be able to monitor and quickly identify aircraft, for example; aircraft exiting runways after landing contacting ground control, positive identification of departing aircraft at the runway. The access to this information will allow for greater efficiency in taxiing and departure and ramp queue management since the taxi path clearance can be tailored to and monitored automatically to achieve throughput objectives. Planning and proactive control of surface traffic is made possible when controllers know the position of aircraft before initial communication/contact is made.

For both Flight Operations Centers (FOC) and Traffic Flow Management Controllers (TMC), the availability of real-time surface surveillance information will support the development and implementation of applications designed expressly to improve traffic management and projections across all phases of flight. By adding information on both the individual flight movement and aggregate flow on the surface this knowledge can be incorporated into the operational planning and decision processes over 20 minutes earlier with more accuracy, thus vastly improving the ability to project and identify periods of excess demand and other congestion. The increased accuracy will be directly reflected in more extensive Collaborative Decision Making (CDM), made possible by the more accurate, common situational awareness of not only the specific surface environment, but also the impacts across all phases of NAS operation.

Benefits, Performance and Metrics

Performance/Benefits	Metrics
Departure throughput rates will increase and average taxi-out times decrease due to better sequencing and load balancing at departure	• Aggregate sum of inter-departure spacing times should be reduced for all flights in the presence of a queue.
Improved traffic flow and increased situational awareness will decrease the taxi-times	• Taxi time from touchdown to gate for equipped flights compared to average for all flights same runway, concourse and time slot • Taxi times and departure throughput rates serve as proxies for improved traffic flow.
Airport surface safety will be improved through increased situational awareness	• Runway incursion incident rate • Taxi-Clearance deviations
Improved communications and coordination will occur between system stakeholders.	• Number of aircraft in departure queue should decline and be more evenly balanced (considering departure path and user preference).

	• Number, duration, and type of ATC communications within the surface area for a specific equipped flight during ground operations compared to average for all flights over same path (same time slot). [Communications focused on present position and intent should be reduced from the baseline.]

Scope and Applicability

Availability of a robust surveillance data fusion capability is essential to increase system efficiency, provide common situational awareness and contribute to increased safety.

- Fusion of Automatic Dependent Surveillance – Broadcast (ADS-B) and multilateration position reporting with Airport Surface Detection Equipment (ASDE) primary radar in ASDE-X: ADS-B will provide accurate downlink of GPS-based position reports for equipped aircraft. Multilateration will provide position reports for all aircraft and vehicles having tagged beacon transmitters.

- Demonstration of Multi-sensor Fusion of Surface Surveillance at Second Site (Louisville) will be conducted in September, 2002

Extension of the CDM methodology includes the provision of surface information via already established distribution architecture.

- Develop Surface Surveillance and Traffic Flow Management Data (CDM) Integration Plan in March 2002.
- Extension of information use across all service provider and user systems, as envisioned in the Concept of Operations, is dependent on establishment of standards for the exchange. Final Interface Standards for Surface Surveillance System will be published September 2002.
- By September 2002, there should be a clear definition of Surface Management System (SMS) and its interfaces. The SMS concept is planned research from the National Aeronautics and Space Administration (NASA). The goal of the SMS research is to provide tools to increase efficiency by, for example; managing departure operations, runway queuing and load balancing. A Surface Management System Trial will be conducted at Memphis in December 2003.
    - Several technologies will provide information upon which the SMS applications will be based to improve shared situational awareness and decision-making. SMS will provide decision-support tools to predict, plan, and advise surface aircraft movements and increase throughput and user flexibility using numerous data sources. SMS can provide controllers with a set of tools for tactical control and strategic planning of aircraft movements (arrivals and departures) on the surface while incorporating airline priorities.

  - Free-Flight Phase One (FFP1) SMA provides transitional capabilities that will ultimately be incorporated in SMS. SMA provides estimated landing times for flights currently in the terminal area, based on information from the local Automated Radar Terminal System (ARTS). This provides users (dispatchers, ramp controllers and other airline personnel) improved information on arrival times to improve gate turnaround and avoid conflicts with gate management

- Independent analysis of benefits, costs and potential for use of SMS functionality across the NAS will support the business case decision for deployment. An independent Analysis of SMS Trial (to include benefits, costs, applicability to other sites) will be conducted in June 2004.
- A deployment decision for SMS will be made in December of 2004, with a target of an operational SMS in December of 2007 if a decision is made to move forward.

NOTE: Technologies that will enhance situational awareness in the cockpit, such as Cockpit Display of Traffic Information (CDTI) are discussed in AD-7.

Key Decisions

- Airport equipage of enabling technologies is critical to achieving the full benefit of SMS.
- Determination after analysis in 2003 Memphis trial on need for Local Area Augmentation System for surface surveillance accuracy requirements.
- Mandatory operation of transponders on the ground.

Key Risks

- Defining a common SMS concept and requirements based on ongoing industry, FAA and NASA activities.
- Completing a NASA demonstration at Memphis in 2003.
- RTCA and international standards for surveillance data and avionics interfaces and protocols are on the critical path for scheduling.
- Deployment schedule for ASDE-X.
- Operational concept validation in Safe Flight 21.